**What is claimed is:**

1. A substrate support comprising:

(a) a support structure; and

(b) a coating on the support structure, the coating comprising a carbon-hydrogen network, and the coating having a contact surface comprising a coefficient of friction of less than about 0.3 and a hardness of at least about 8 GPa, whereby the contact surface of the coating is capable of reducing abrasion and contamination of a substrate that contacts the contact surface.

2. A support according to claim 1 wherein the coating comprises a diamond-like material.

3. A support according to claim 2 wherein the diamond-like material comprises diamond-like carbon.

4. A support according to claim 2 wherein the diamond-like material comprises a diamond-like nanocomposite having networks of (i) carbon and hydrogen, and (ii) silicon and oxygen.

5. A support according to claim 2 wherein the diamond-like material comprises a resistivity of from about $10^4$ Ohm·cm to about $10^8$ Ohm·cm.

6. A support according to claim 5 wherein the diamond-like material comprises from about 0.1 atom % to about 10 atom % of a metal additive, whereby the metal additive changes the resistivity of the coating.

7. A support according to claim 1 wherein the support structure comprises:

(i) a dielectric covering an electrode; and

(ii) a plurality of mesas on the dielectric, the mesas comprising the coating with the contact surface thereon.

8. A support according to claim 7 wherein the dielectric comprises a ceramic.

9. A support according to claim 7 further comprising a metal-containing adhesion layer between the dielectric and the coating of the mesas.

10. A support according to 1 wherein the support structure comprises a heat exchanger comprising at least one of (i) a heater, and (ii) conduits for passing a heat exchange fluid therethrough.

11. A support according to claim 1 wherein the support structure comprises a lift pin comprising an elongated member having a tip with the contact surface.

12. A substrate support comprising:

(a) a dielectric covering an electrode; and

(b) a plurality of mesas on the dielectric, the mesas comprising a coating of a diamond-like material over a titanium layer.

13. A support according to claim 12 wherein the coating comprises a coefficient of friction of less than about 0.3 and a hardness of at least about 8 GPa.

14. A support according to claim 12 wherein the coating comprises a thickness of from about 1 to about 20 microns.

15. A support according to claim 14 wherein the titanium layer comprises a thickness of from about 0.25 to about 4 microns.

16. A support according to claim 12 wherein the diamond-like material comprises a diamond-like nanocomposite having networks of (i) carbon and hydrogen, and (ii) silicon and oxygen.

17. A support according to claim 12 wherein the diamond-like material comprises diamond-like carbon.

18. A support according to claim 12 wherein the diamond-like material comprises a metal additive.

19. A support according to claim 12 wherein the dielectric comprises AlN or $Al_2O_3$.

20. A support according to claim 12 wherein the diamond-like material is co-deposited with the metal additive by a process combining physical vapor deposition of the metal additive in a plasma enhanced chemical vapor deposition environment.

21. A substrate support comprising:

(a) a support structure having a ceramic contact surface comprising a metal concentration level of less than about $5 \times 10^{12}$ atoms/$cm^2$ of metal, whereby the contact surface is capable of reducing contamination of the substrate.

22. A support according to claim 21 wherein the ceramic contact surface comprises silicon carbide.

23. A support according to claim 21 wherein the ceramic contact surface comprises silicon nitride.

24. A support according to claim 21 wherein the ceramic contact surface is a surface of a coating.

25. A support according to claim 21 comprising:

(b) a dielectric covering an electrode; and

(c) a plurality of mesas on the dielectric, the mesas having the ceramic contact surface thereon.

26. A substrate heat exchange pedestal comprising:

(a) a support structure having a coating comprising a diamond-like material; and

(b) a heat exchanger in the support structure, the heat exchanger capable of heating or cooling a substrate.

27. A pedestal according to claim 26 wherein the diamond-like material comprises diamond-like carbon.

28. A pedestal according to claim 26 wherein the diamond-like material comprises a diamond-like nanocomposite having networks of (i) carbon and hydrogen, and (ii) silicon and oxygen.

29. A pedestal according to claim 26 having an adhesion layer comprising titanium below the diamond-like material.

30. A pedestal according to claim 26 wherein the contact surface of the coating comprises a plurality of grooves therein.

31. A substrate heat exchange pedestal comprising:

(a) a support structure having a coating comprising silicon carbide having a metal contaminant concentration level of less than about $5 \times 10^{12}$ atoms/$cm^2$ of metal, with a contact surface that is capable of reducing contamination of the substrate; and

(b) a heat exchanger in the support structure, the heat exchanger capable of heating or cooling the substrate.

32. A pedestal according to claim 31 wherein the support structure comprises a pedestal body having an upper surface, and comprising a cap covering the upper surface of the pedestal body, the cap comprising a base layer that is substantially entirely covered by the coating.

33. A pedestal according to claim 32 wherein the base layer comprises graphite.

34. A pedestal according to claim 32 wherein the base layer comprises silicon infiltrated silicon carbide.

35. A pedestal according to claim 31 wherein the coating comprises sintered silicon carbide comprising a metal contaminant concentration level of less than about $5X10^{12}$ atoms/$cm^2$ of metal.

36. A substrate heat exchange pedestal comprising:

(a) a support structure having a coating comprising silicon nitride with a contact surface having a metal contaminant concentration level of less than about 5 x $10^{12}$ atoms/$cm^2$ of metal that is capable of reducing contamination of the substrate; and

(b) a heat exchanger in the support structure, the heat exchanger capable of heating or cooling the substrate.

37. A shutter to inhibit deposition of material on a surface of a substrate support and to reduce frictional contamination, the shutter comprising:

(a) a metal disc that covers at least a portion of the surface, wherein the disc comprises a lower surface having a coating of diamond-like material with coefficient of friction of less than about 0.3 and a hardness of at least about 8 Gpa, whereby the coating is capable of reducing contamination of the support surface by metal particulates when the lower surface contacts the support surface.

38. A shutter according to claim 37 wherein the diamond-like material comprises diamond-like carbon.

39. A support according to claim 37 wherein the diamond-like material comprises a diamond-like nanocomposite having networks of (i) carbon and hydrogen, and (ii) silicon and oxygen.

40. A shutter to inhibit the deposition of material on a surface of a substrate support and to reduce frictional contamination, the shutter comprising:

(a) a metal disc that covers at least a portion of the surface, wherein the disc comprises a lower surface comprising a ceramic coating having less than about 5X$10^{12}$ atoms/$cm^2$ of contaminant metal, whereby the lower surface is capable of reducing contamination of the support surface by metal particulates when the lower surface contacts the support surface.

41. A shutter according to claim 40 wherein the ceramic coating comprises silicon nitride.

42. A shutter according to claim 40 wherein the ceramic coating comprises silicon.

43. A lift pin assembly to lift a substrate from a support, the lift pin assembly comprising:

(a) a plurality of lift pins, each lift pin comprising a movable elongated member having a tip, the tip comprising a contact surface to contact the substrate, wherein the contact surface comprises a diamond-like material.

44. A lift pin assembly to lift a substrate from a support, the lift pin assembly comprising:

(a) a plurality of lift pins, each lift pin comprising a movable elongated member having a tip comprising a ceramic contact surface to contact the substrate, wherein the ceramic contact surface comprises a metal contaminant concentration level of less than about $5 \times 10^{12}$ atoms/$cm^2$ of metal.

45. A lift pin assembly according to claim 44 wherein the ceramic contact surface comprises silicon nitride.

46. A lift pin assembly according to claim 44 wherein the contact surface comprises silicon carbide.

47. A heat exchange pedestal capable of exchanging heat with a substrate, the heat exchange pedestal comprising:

(a) a metal body having an upper surface; and

(b) a coating covering the upper surface, the coating having a contact surface that can contact a substrate; and

(c) a heat exchanger below the contact surface, the heat exchanger capable of heating or cooling the substrate.

48. A pedestal according to claim 47 wherein the metal body comprises at least one of aluminum, stainless steel and titanium.

49. A pedestal according to claim 47 wherein the coating comprises a diamond-like material.

50. A pedestal according to claim 47 wherein the coating comprises silicon carbide having a metal contaminant concentration level of less than about 5 x $10^{12}$ atoms/$cm^2$ of metal atoms.

51. A pedestal according to claim 47 wherein the coating comprises silicon nitride having a metal contaminant concentration level of less than about 5 x $10^{12}$ atoms/$cm^2$ of metal atoms.

52. A method of coating a support component in a plasma zone, the method comprising:

(a) placing a support structure in a plasma zone, the support structure having a surface;

(b) sputtering a metal to deposit sputtered metal on the surface of the support structure; and

(c) during step (b), introducing a process gas into the plasma zone to deposit a chemical vapor deposition material on the surface of the support structure simultaneously with the sputtered metal.

53. A method according to claim 52 comprising sputtering a metal that is at least one of titanium and tungsten.

54. A method according to claim 52 wherein the process gas comprises a carbon and hydrogen containing gas.

55. A method according to claim 52 comprising applying a power to a magnetron about a sputtering target comprising the metal to sputter the metal target.

56. A method according to claim 52 comprising the initial step of cleaning a residual coating off from the support structure before step (a).

57. A method according to claim 52 comprising cleaning the residual coating by reactive ion etching.